Performance Analysis Of Geocast Routing Protocol In Vehicular Ad-hoc Network

Pooja Mane, Reshma Zambare, Priyanka Kanake,Priyanka Harale * Prof: Uma Nagaraj

Abstract— **Vehicular Ad-hoc Network(VANET) is a sub class of MANET, is a promising Approach for the Intelligent Transport System. As day by day driving become more challenging as compared to the previous era. So there is need of technology to manage transportation very intelligently for that Technology termed as Vehicular Ad-hoc Network(VANET) can be used efficiently. Vehicular Ad-hoc Network(VANET) leads to road safety, traffic management efficiently. In this technology various routing protocols are designed for communication between vehicles(V2V) as well as infrastructure(V2I). There are certain issues related with the Massage Forwarding in previously used routing protocols.To overcome that issues Geocast routing Protocol can become a good solution.Its objective is to deliver the packet from source node to all other nodes within a specified geographical region (Zone of Relevance ZOR). The main purpose of Geocasting is to deliver a message to nodes within a geographical region.Geocast provides some services like finding friends who are nearby, geographic advertising, and accident or wrong-way driver warning on a motorway.**

Index Terms— **Vehicular Ad-hoc Networks (VANETs), Vehicle Identification Number (VIN), Road Side Unit(RSU),Vehicle to Vehicle(V2V), Vehicle to Infrastructure(V2I),Zone of Relevance (ZOR), Zone of Forwarding (ZOF), Packet Delivery Ratio (PDR).**.

I. INTRODUCTION

With the sharp increase of vehicles on road in the recent years, driving has not stopped from being more challenging and dangerous. Road saturated, safety distance and clear and reasonable speed are hardly respected, drivers often lack enough attention. To improve the safety, security and efficiency of the Intelligence transportation system have been developed, which apply rapidly emerging information technologies in vehicles and transportation infrastructures. From the network perspective, security is one of the most significant challenges. Vehicle safety applications are among the major drivers for VANETs Where people's lives are at stake. Vehicular ad hoc networking is an important component of Intelligent Transportation Systems. The main benefit of VANET communication is seen in active safety systems that increase passenger safety by exchanging warning messages between vehicles. Other applications and private services are also permitted in order to lower the cost and to encourage VANET deployment and adoption services.

Manuscript received Apr 2014.
Pooja Mane, *Computer Engineering, Pune University/ MIT Academy Of Engineering/ MIT Group of Collages., Pune, India,8600968500*
Reshma Zambare, *Computer Engineering, Pune University/ MIT Academy Of Engineering/ MIT Group of Collages.,Pune, India,8483010112*
Priyanka Kanake, *Computer Engineering, Pune University/ MIT Academy Of Engineering/ MIT Group of Collages., Pune, India,,9890860017*
Priyanka Harale, *Computer Engineering, Pune University/ MIT Academy Of Engineering/ MIT Group of Collages., Pune, India,9420858975*

s

II. VEHICULAR AD HOC NETWORK (VANET)

A Vehicular Ad-Hoc Network, or VANET, is a form of mobile ad-hoc network, to provide communications among nearby vehicles and between vehicles and nearby fixed equipment, usually described as road side equipment. It is a promising approach for the intelligent transportation system (ITS)[13].

It deals with transportation management which provides information that avoids traffic and some accidents also which leads to safety for life of human beings.
This information consist of messages which can help to takes a decision according to the situation. Consider a scenario suppose vehicle A want to go destination B and in between of route some where traffic is blocked so it will create difficultly for A to reach at the destination B. In this situation we can avoid that difficulty by conveying message in advance to vehicle A so A can take decision like he can change route.
So that's how Vehicular Ad-Hoc Network technology works.

The design of routing protocols in VANETs is important and necessary issue for support the smart ITS.
VANETs can be utilized for a broad range of safety and non-safety applications, allow for value added services such as vehicle safety, automated toll payment, traffic management, enhanced navigation, location-based services such as finding the closest fuel station, restaurant or travel lodge and infotainment applications such as providing access

to the Internet.

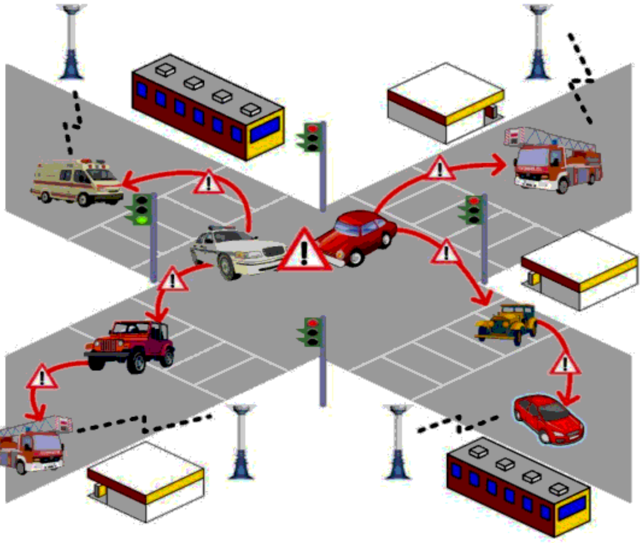

Fig 1 :General Scenario of VANET

By introducing vehicular networking technologies.
This technology can be applied either in its vehicle-to-vehicle (V2V)[15] or vehicle-to-infrastructure(V2I) form, stakeholders envision many e-Safety applications that will enhance traffic safety. For example, applications can provide drivers earlier with additional information on traffic situations to help them react appropriately and timely to potential dangers. Obviously, such information could be especially helpful in the case of emergency response operations. For example, an approaching emergency vehicle could send warning messages to neighboring vehicles periodically to inform them about its current position and speed. Similarly, such messages could be used for traffic light preemption where the traffic lights switch to green in the direction of the emergency vehicle while blocking crossing directions. When stopping at an accident site, an emergency vehicle can continue emitting warning messages to inform approaching vehicles of the accident.

III. OVERVIEW OF ROUTING PROTOCOLS:

Classification of routing protocols in vehicular ad hoc network[6] can be done in many ways, but most of these are done depending on routing strategy and network 0structure. The routing protocols can be categorized as flat routing, hierarchical routing and geographic position[3] assisted routing while depending on the network structure. According to the routing strategy routing protocols can be classified as Table-driven and source initiated. Routing protocols for VANETs can be classified as either reactive or proactive. This classification is based on the way a protocol tries to find a route to a destination[1].

A. **Proactive protocols:**

Proactive protocols are based on periodic exchange of control messages and maintaining routing tables Each node maintains complete information about the network topology locally. This information is collected through proactive exchange of partial routing tables stored at each node. Since each node knows the complete topology, a node can immediately find the best route to a destination. However, a proactive protocol generates large volume of control messages and this may take up a large part of the available bandwidth[1]. The control messages may consume almost the entire bandwidth with a large number of nodes and increased mobility. **Examples of proactive protocols are:** Destination Sequenced Distance Vector (DSDV).

B. **Reactive Protocols:**

In a reactive protocol, a route is discovered only when it is necessary. In other words, the protocol tries to discover a route only on-demand, when it is necessary. It usually These protocols generate much less control traffic at the cost of latency, i.e., take more time to find a route compared to a proactive protocol. **Examples of reactive protocols are:** Dynamic Source Routing (DSR), Ad hoc On-demand Distance Vector (AODV),Geocast Routing Protocol(GRP).

In VANET, there are different types of routing protocols: Topology based, Position based, Cluster based, Geocast , Broadcast.

IV. CLASSIFICATION OF ROUTING PROTOCOL

A. **Topology based Routing protocols:**

It uses links information that exist in the network to perform packet forwarding. They are further divided into Proactive and Reactive. The proactive routing means that the routing information like next forwarding hope is maintained in the background irrespective of communication requests [1]. The packets are constantly broadcast and flooded among nodes to maintain the path, then a table is constructed within a node which indicates next hop node towards a destination. The advantage of proactive routing protocols is that there is no route discovery is required since the destination route is stored in the background, but the disadvantage of this protocol is that it provides low latency for real time application, it also leads to the maintenance of unused data paths, which causes the reduction in the available bandwidth.

B. **Position based Routing protocols:**

It consists class of routing algorithm. They share the property of using geographic positioning information in order to select the next forwarding hops. The packet is sent without any map knowledge to the one hop neighbour which is closest to destination. Position based routing is beneficial since no global route from source node to destination node need to be created and maintained[7]. Position based routing is broadly divided in two types: Position based greedy V2V protocols, Delay Tolerant Protocols.

C. **Broadcast Routing protocols:**

It is frequently used in VANET for sharing, traffic, weather and emergency, road conditions among vehicles and delivering advertisements and announcements. Broadcasting is used when message needs to be disseminated to the vehicle beyond the transmission range i.e multi hops are used[7]. Broadcast sends a packet to all nodes in the network, typically using flooding. This ensures the delivery of the packet but bandwidth is wasted and nodes receive duplicates. In VANET, it performs better for a small number of nodes.

D. **Geocast Routing protocols:**

It is basically a location based multicast routing. Its objective is to deliver the packet from source node to all other nodes within a specified geographical region (Zone of Relevance ZOR). In Geocast routing vehicles outside the ZOR are not alerted to avoid unnecessary hasty reaction. Geocast[3] is considered as a multicast service within a specific geographic region. It normally defines a forwarding zone where it directs the flooding of packets in order to reduce message overhead and network congestion caused by simply flooding packets everywhere[7]. In the destination zone, unicast routing can be used to forward the packet. One pitfall of Geocast is network partitioning and also unfavourable neighbours which may hinder the proper forwarding of messages.

E. **Cluster Based Routing Protocols:**

Virtual Infrastructure is created through clustering of nodes in order to provide scalability. Each cluster can have a cluster head, which is responsible for secure communication between inter-cluster and intra cluster coordination in the network. Recovery strategy is used to recover from unfavourable situations. Recovery strategy is the criteria, which is used to judge the performance of protocol .Clustering is one solution for the scalability problem and is vital for efficient resource consumption and load balancing in large scale networks. These parameters can increase stability and connectivity and can reduce overhead in network. On the other hand, transmission range of a vehicle is important for forwarding and receiving messages. When a fixed transmission range mechanism is used in VANET, it is likely that vehicles are not located in the range of their neighbours. This is because of the high-rate topology changes and high variability in vehicles density. Transmission range of a vehicle is important for forwarding and receiving messages. When a fixed transmission range mechanism is used in VANET, it is likely that vehicles are not located in the range of their neighbours. This is because of the high-rate topology changes and high variability in vehicles density. An algorithm may be designed for adaptive allocation of transmission range, where messages and density of traffic around vehicles are used to adaptively adjust the transmission range among them. Also monitoring of malicious vehicle algorithm may be suggested to determine a distrust value for each vehicle used in the VWCA.

V.

GEOCAST ROUTING PROTOCOL

The main purpose of Geocast routing protocol is forwarding message to nodes within a geographical region.

Geocasting, a form of the conventional multicasting problem, distinguishes itself by specifying hosts as group members within a specified geographical region termed as Zone of Relevance.

In geocasting, the nodes eligible to receive packets are implicitly specified by a physical region; membership in a geocast group changes whenever a mobile node (MN) moves in or out of the geocast region.That means if vehicle moving from one location to another location accordingly ZOR may changed for that vehicle.

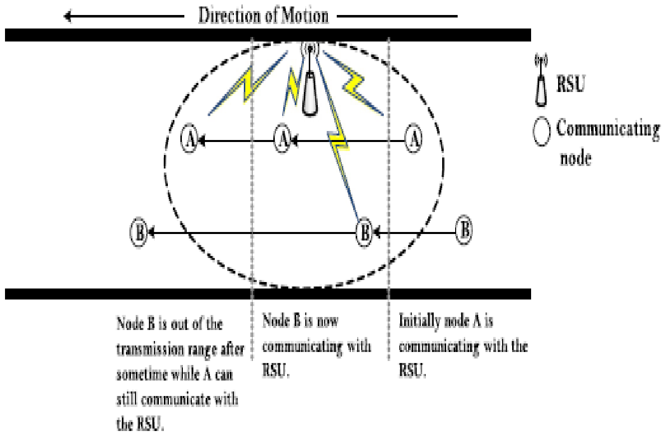

Fig 2(a): Communication of Geocast Routing Protocol

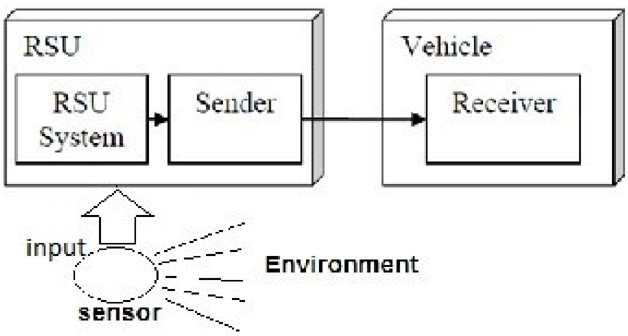

Fig 2(b) Communication between I2V

The above diagram shows how the communication takes place between Vehicles and Infrastructure through intermediate component called as Road Side Unit(RSU).

There are exist multipleGeocast routing protocol in VANET: IVG, Cached Geocast, Abiding Geocast, DRG, ROVER, DG-CastoR, Mobicast[11], DTSG, Constrained Geocast

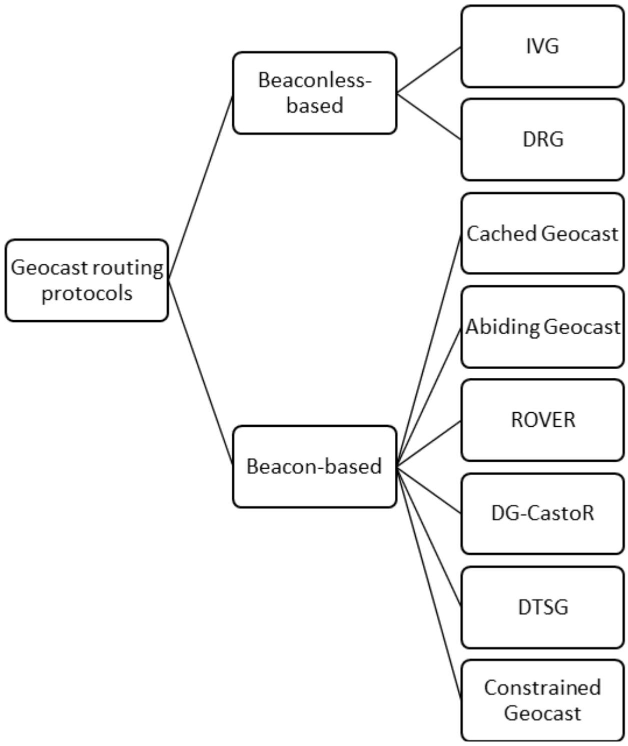

Fig 3. Geocast Routing protocols

A. **Inter-Vehicular Geocast(IVG)**

The purpose of IVG is to inform vehicles located in a risk area called multicast group about any danger on the highway. To achieve this goal, the risk area is determined considering the precise obstacle location on the road and the driving directions which can be affected [9]. The damaged vehicle broadcasts a message alert to the multicast group.

B. Cached Geocast

In cached geocast there is need to add cache to routing layer to store geocast messages to locate vehicle by using greedy forwarding technique[8].It consists of a dynamic transmission range R based on the real transmission range and the current nodes velocities. On relay selection, the most distant (nearest to destination) node within the range R is chosen.

C. Abiding Geocast

Abiding Geocast that allows a periodical delivery of a Geocast message in Ad Hoc Networks. It may works in three ways Firstly, the use of a server that stores Geocast message (Unicasted from the source). Then the server uses a Geocast protocol to periodically deliver the Geocast message to the destination zone. Secondly, a node is elected in the relevant destination area in order to store the Geocast message and periodically or by notification retransmit it. Thirdly, the neighbour approach consists to allow all nodes to store the Geocast message. Hand over is done on entry and message delivery by notification.

D. **Reliable Geographical Multicast Routing**

In Vehicular Ad-hoc Network, a technique similar to AODV which consists in broadcasting only control packets, while data packets are unicasted (a periodic beaconing system is used) [12].

a) Each vehicle is identified by an Identification Number,
b) Each vehicle is equipped with a GPS receiver,
c) Vehicles have access to a digital map,
d)ZOR is a rectangle area,
e) ZOF includes the sender and the ZOR.

The goal of ROVER is to deliver an application generated message to all vehicles located into the specified ZOR.

VI. IMPLEMENTATION DETAILS

We distinguish three relevance classes[5] for warning messages:

Forwarding only. RN and EV are moving in opposite directions or have divergent routes. Messages are forwarded but are ignored locally.

Information only:. RN and EV have divergent routes, but d < r, i.e., RN is in the range of EV and the siren is audible. E.g., an information message should be presented to drivers to prevent confusion when hearing the siren.

Active warning:. RN and EV are on the same road or their routes will intersect with high probability. An appropriate action has to be initiated, e.g., a warning should be displayed to the driver with specific instructions for proper reaction . Roadside units can evaluate the relevance of received messages similarly, taking vRN = 0. The result of the local relevance definition determines the kind of action that will be initiated by the receiver component.

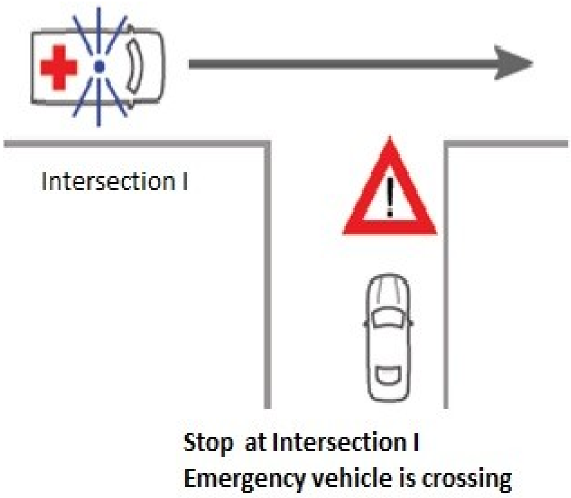

Fig 4 : Active warning when entering an intersection while emergency vehicle is crossing.

VII. SYSTEM ARCHITECTURE

This Architecture contains sending nodes , receiving nodes and RSU which will responsible for establishing communication between V2V and V2I. EV broadcast message to all vehicles which comes under that ZOR. this will done through RSU which is going to regulate traffic for that region , according to that decision will be taken by RN on the basis of warning messages of relevance class.

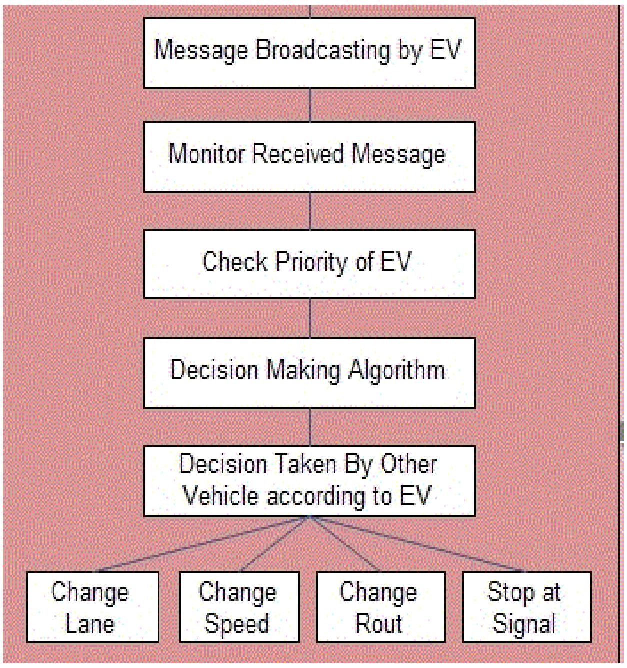

Fig 5 : System architecture

If you are using *Word,* use either the Microsoft Equation Editor or the *MathType* add-on (http://www.mathtype.com) for equations in your paper (Insert | Object | Create New | Microsoft Equation *or MathType* Equation). "Float over text" should *not* be selected

VIII. ALGORITHM

These are the algorithm that we are going to implement in are application for different purpose:

1. BroadCast Algorithm:

Broadcast algorithm is to generate and send the message periodically.

If (distance(prev-loc, curr_loc) > 1000m) OR ((prev_time - curr_time) > 30sec)
OR (prev_road != curr_road) OR (prev_lane != curr_lane){
Generate_Full_warning_message();
Generate_Lightweight_warning_message();
broadcastMessage();}
Generate_Full_warning_message(){
Message(ID, CODE, priority, curr_loc, curr_speed, curr_dir, curr_road, curr_lane, Partial_rout_path);} // CODE is according to the type of EV
Generate_ Lightweight _warning_message()//No path information added{
Message(priority, curr_loc, curr_speed, curr_dir, curr_road, curr_lane);}

2. Decision Algorithm:

After receiving message at receiving side decision can be taken as below.

If (new_msg arrive){read_msg();
If(msg from more than EV){checkPriority(EV);}
If(EV is in opposite direction)Msg_forword_only();
If(EV have divergent rout)// i. e. Siren_is_Audioable
Msg_Information_only();if(EV is on same road)//Active warning{
If(on same lane){Calculate_time_to_arrive_EV(curr_pos, speed_of_EV);
If(another lane is available)changeLane();else minimize the speed;}}
If(may cross at next Square){Stop at next Square and let EV to go.}}

3. Priority Algorithm:

Priority algorithm is used to assign the priority according to the type of EV and take the action according to priority.
There are three types of EV Ambulance, Police car, Fire Truck

assignPriority(){ If (type_of_EV == Ambulance)setPriority(1);
If (type_of_EV == FireTruck)setPriority(2);
If (type_of_EV == PoliceCar)setPriority(3);}
checkPriority(){ If(more than one msgcome at once){Find_High_Priority();
Take_action_according_to_decision_algo_FOR_HIGH_priority();}}

IX. RESULT

We did implementation of Geocast Routing Protocol In Vehicular Ad-Hoc Network for emergency vehicle. In that we considered some scenarios which shows working of GRP through emergency vehicle application. Basically Geocast Routing protocol functioning on geographical area considering some algorithm like Broadcast, Priority, Decision algorithms. We able to communicate among vehicles through RSU. As shown in Fig. 6 the messages overhead reduced in GRP as messages delivered within a range(ZOR) instead of broadcasting to all vehicles.

-

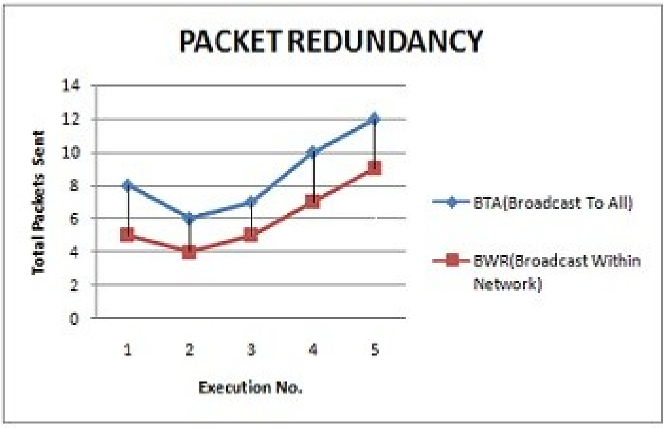

Fig 6 : Comparison of Packet delivary between broadcast to all and broadcast within network.

Above graph shows how Geocast protocol reduce packet overhead as compared to broadcasting to all. In broadcasting packets are delivered to all vehicle which comes under particular network and on the other hand in Gecast Routing protocol the packets are deliver to only that vehicles which come under particular ZOR which results into efficient use of bandwidth.

X. CONCLUSION

We present the Geocast Routing protocol (GRP), and forwarding algorithm particularly designed for vehicular ad-hoc network based on the partial knowledge about the network geographical state and assistance of the city road map. Using VANET technology to deliver additional information about emergency vehicle positions, speeds, and routes to other traffic participants and infrastructure can help to make such operations safer and faster, and thus potentially safe lives. We think that enabling emergency vehicle applications could also significantly contribute to the market introduction of VANET technology and needs further attention beyond the current level. In realistic urban environment, there may be many obstacles such as buildings and trees along the street, which make communication of nodes in adjacent streets impossible.

FUTURE WORK

Geocast Routing protocol still have many challenges that have not been examined yet. These challenges provide great opportunities for the new researchers, as VANET is a vast technology. When the greedy forwarding fails in position-based routing, the right-hand rule is applied which increases the length of the path. Also this happens in the geocast routing when the nodes move in distance-based forwarding zone. So, there is a need to propose a method which reduces this length. In geocast routing, flooding consumes time so efforts should be made to reduce this time.

REFERENCES

[1] Yun-Wei Lin, Yuh-Shyan Chen And Sing-Ling Lee "Routing Protocols in Vehicular Ad Hoc Networks-A Survey and Future Perspectives", JOURNAL OF INFORMATION SCIENCE AND ENGINEERING 26, 913-932 (2010), Department of Computer Science and Information Engineering, National Chung Cheng University Chiayi, 621 Taiwan.
[2] Christian Maihofer ,Daimlerchrysler Ac "A Survey Of Geocast Routing Protocols", IEEE COMMUNICATIONS S U R V E Y S- The Electronic Magazine of Original Peer-Reviewed Survey Articles(2004).
[3] Ben Bovée, Mohammad Nekoui, Hossein Pishro-Nik and Russell Tessier."Evaluation of the Universal Geocast Scheme For VANETs", Department of Electrical and Computer Engineering, University of Massachusetts, Amherst, MA.
[4] Yan-Bo Wang, Tin-Yu Wu, Wei-Tsong Le, Chih-Heng Ke, "A Novel Geographic Routing Strategy over VANET", Department of Electrical Engineering, Tamkang University Ying-Chuan Rd. Tamsui. Taipei County, Taiwan.
[5] Andreas Buchenscheit, Florian Schaub, Frank Kargl, and Michael Weber," A VANET-based Emergency Vehicle Warning System",Institute of Media Informatics, Ulm University, Germany.
[6]Sheriali Zeadally,Ray Hunt,Yuh-Shan,"Vehicluar Ad-hoc Networks (VANET):Status,Results,Challenges",Deparment of Computer science and Information technology,USA.
[7] Sandhya Kholi,Bandot kaur,Sabina Bindra,"A comparative Study of Routiong Protocol",Department of CSE.
[8] "Geocast Routing Protocols for VANETs: Survey and Geometry-Driven Scheme Proposal"Salim Allal*, Saadi Boudjit Laboratoire de Traitement et Transport de l'Information .
[9] "A multicast protocol in ad hoc networks inter-vehicle geocast". A. Bachir and A. Benslimane. In Proc. Of the 57th IEEE Semiannual Vehicular Technology on ference (VTC 2003-Spring), Seogwipo, Korea.
[10] C. Maih¨ofer, T. Leinm¨uller, and E. Schoch. "Abiding geocast: time–stable geocast for ad hoc networks". In proc. of the 2nd ACM international workshop on Vehicular ad hoc networks (VANET'05), Cologne, Germany.
[11]Y. S. Chen, Y. W. Lin, and S. L. Lee. A mobicast routing protocol for vehicular ad hoc networks. ACM/Springer Mobile Networks and Applications (MONET).
[12]M. Kihl, M. Sichitiu, T. Ekeroth, and M. Rozenberg. Reliable geographical multicast routing in vehicular ad hoc networks. In Proc. of the 5th International Conference on Wired/Wireless Internet Communications (WWIC'07), Coimbra, Portugal.
[13] Bilal Mustafa, Umar Waqas Raja, "Issues Routing in VANET", M.S thesis, Bleking Institute of Technology, Sweden.
[14] A. K. Saha and D. B. Johnson, "Modeling mobility for vehicular ad hoc networks," in Proceedings of ACM International Workshop on Vehicular Ad Hoc Networks.
[15] Harsch, C., Festag, A., & Papadimitratos, P. (2007). Securev position-based routing for VANETs.
[16] Chen, Y., Lin, Y., & Lee, S. (2010). A mobicast routing protocol for vehicular ad- hoc networks. ACM/Springer Mobile Networksand Applications.

Pooja Mane: Studying at MIT Academy Of Engineering Pune, ,Working on project named Geocast Routing Protocol in Vehicular Ad-Hoc Network.

Reshma Zambare: Studying at MIT Academy Of Engineering Pune, ,Working on project named Geocast Routing Protocol in Vehicular Ad-Hoc Network.

Priyanka Kanake: Studying at MIT Academy Of Engineering Pune, ,Working on project named Geocast Routing Protocol in Vehicular Ad-Hoc Network.

Priyanka Harale: Studying at MIT Academy Of Engineering Pune, ,Working on project named Geocast Routing Protocol in Vehicular Ad-Hoc Network.

